Small Business Innovation Research/Small Business Tech Transfer

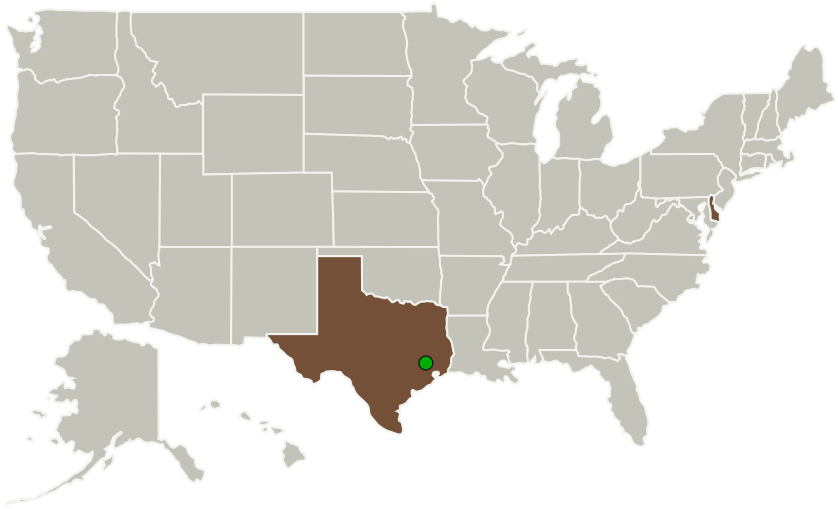
Shear Thickening Fluid Enhanced Textiles for Durable, Puncture- and Cut-Resistant Environmental Protection Garments, Phase I

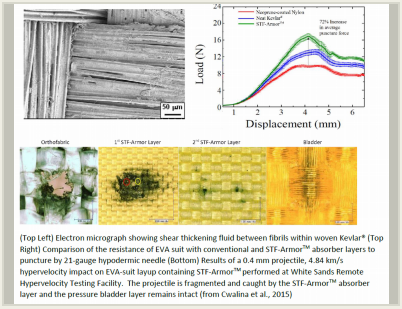
Completed Technology Project (2016 - 2017)

Project Introduction

This Small Business Technology Transfer Research Phase I proposal will develop and advance the commercialization of STF-ArmorTM nanocomposite materials for use in Environmental Protection Garments (EPG) for long-duration exploration missions, such as the exploration of Mars. The proposed STTR research leverages the results of NASA-sponsored research conducted at the University of Delaware, combined with a commercialization pathway provided by STF Technologies LLC and our commercialization partners, to develop advanced EPG materials to improve astronaut safety. Shear thickening fluid (STF) nanocomposite textiles have been demonstrated to offer a mass-efficient means for improving the puncture and MMOD resistance of EVA suits as a superior absorber layer. The proposed research will advance the commercialization and TRL by optimizing STF materials, treatments and prototype EPG lay-ups to provide enhanced durability, puncture-, cut-, and dust-resistance while simultaneously meeting the requirements for full integration into EPGs and suit systems.

Primary U.S. Work Locations and Key Partners





(Top Left) Electron micrograph showing shear thickening fluid between fibrils within woven Kevlar® (Top Right) Comparison of the resistance of EVA suit with conventional and STF-Armor™ absorber layers to puncture by 21-gauge hypodermic needle (Bottom) Results of a 0.4 mm projectile, 4.84 km/s hypervelocity impact on EVA-suit layup containing STF-Armor™ performed at White Sands Remote Hypervelocity Testing Facility. The projectile is fragmented and caught by the STF-Armor™ absorber layer and the pressure bladder layer remains intact (from Cwalina et al., 2015)

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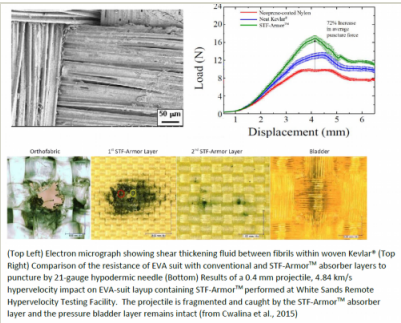
Organizations Performing Work	Role	Type	Location
STF Technologies, LLC	Lead Organization	Industry	Newark, Delaware
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas
University of Delaware	Supporting Organization	Academia	Newark, Delaware

Primary U.S. Work Locations	
Delaware	Texas

Images



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Briefing Chart Image
Shear Thickening Fluid Enhanced Textiles for Durable, Puncture- and Cut-Resistant Environmental Protection Garments, Phase I *(https://techport.nasa.gov/image/126517)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
STF Technologies, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

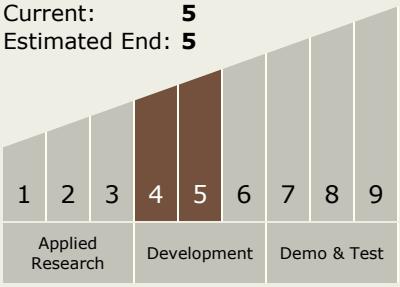
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Richard Dombrowski

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Completed Technology Project (2016 - 2017)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.2 Extravehicular Activity Systems
    - TX06.2.1 Pressure Garment